by an admirable extension of the method of exhaustion are considered, and copiously illustrated; and the introduction concludes with a most useful account of the mathematical terms and phraseology employed by Archimedes.

Dr. Heath's general treatment of the text is excellent, but there is one point on which we do not think that he has exercised a sound judgment. This is the renumbering of the propositions in three of the books, which renders reference to them a matter of entire uncertainty. Thus the celebrated Prop. 37 of Book I. on the Sphere and Cylinder, which gives $\frac{2}{3}$ as the ratio of the surfaces and of the volumes of a sphere and the cylinder that just contains it, appears in Dr. Heath's book as a corollary of Prop. 36, which is numbered 34; he further puts Props. 33, 43, 45, 46 as corollaries, and includes Prop. 1 in the introductory letter, thus reducing to 44 the 50 propositions of the MSS. In Book II. he treats Prop. 1 similarly, even though Archimedes himself, in the introductory letter to his work on Spirals (p. 152), mentions this proposition as the first of those which were proved in this book. In the book on Conoids and Spheroids he further puts as a Lemma what appears as Prop. 1 in all the Greek and Latin texts, so that the famed Prop. 12 on certain plane sections of these figures, the characters of which are said by Archimedes to be *φανεραί*, appears as Prop. 11, and Prop. 18 is put as the third part of Prop. 17 (numbered 16)—without any reason, since it is not an extension of, though deducible from, the other parts.

Complete as the book is, there is one addition that would be welcomed by all students, viz. a table of all the writers named, and of the approximate dates at which they flourished; this, if of easy reference, would be of great help when the relation of different geometers to any problem was under consideration. A larger number of references is also desirable in the interests of the student who is stirred to go to the fountain-head by his thirst for first-hand information. Thus the proofs on pp. liv–lviii of the above-cited Prop. 12 on Conoids and Spheroids are so introduced, especially in being contrasted with Zeuthen's, as to appear to be quite modern, while really being contained in Torelli's edition, and practically also in the earlier editions of Maurolycus and Rivaltus.

We feel much inclined to challenge Dr. Heath's rendering of Euclid's definition of a straight line in his note on p. 3, and to maintain the correctness of the ordinary version of it. The special point seems to us to lie in the word *ἐπί*, "on," the use of which seems to be due to the thought in the writer's mind of points marked by letters over the line; thus Aristotle ("Ethics," v. 4, 12) writes *ἴσαι αἱ* [*i.e. γραμμαί*] *ἐφ' ὧν* ΑΑ, ΒΒ, ΓΓ *ἀλλήλαις* where the sentence can only mean "the lines AA, BB, CC are equal to one another"; the words must therefore mean "the lines are equal over the two ends of which A and A, B and B, C and C are written," so that Euclid's *τὰ ἐφ' ἑαυτῆς σημεῖα* must mean "its own extreme points."

Such slight blemishes, however, or what we deem to be such, do not detract from the very great value of this work, and Dr. Heath deserves our grateful thanks for the labour he has expended upon it. It is a fitting addition to his former task; for as, to quote Charles, in Apollonius work we find the origin of the geometry of Forms and Situations as it is now developed, so in the present book we are introduced to the basis of the geometry of Measurement which has demanded a new calculus for its perfection.

R. E. B.

A NEW TEXT-BOOK OF EXPERIMENTAL PHYSIOLOGY.

The Essentials of Experimental Physiology. For the use of Students. By T. G. Brodie, M.D., Lecturer on Physiology, St. Thomas's Hospital Medical School. Pp. xiv + 231. (London: Longmans, Green, and Co., 1898.)

THIS volume appears in the same series as two books already well known to the medical student of this country, viz. Schäfer's "Essentials of Histology" and Halliburton's "Essentials of Chemical Physiology." It is bound uniformly with these two volumes, but on opening the books all resemblance disappears. Instead of being divided into a number of "lessons," each of suitable length for one day's work of a practical class, the new volume is divided into "chapters" the length of which bears no proportion to the practical work of a class-meeting. In the other two volumes of the series, each lesson is commenced by a concise and definite description for the student of how to perform a number of experiments; and this description is followed by a few pages of theoretical teaching bearing on those experiments. In the present volume this arrangement is departed from, and the experiments are interpolated in a discursive fashion through the text.

An attempt is made to mark off by heavy type a portion of the book as an elementary course, but it is questionable whether this would not have been much better done by dividing the volume into an elementary and advanced course, as has been done by Prof. Halliburton in the "Essentials of Chemical Physiology." Again, some of the experiments described in this elementary portion are quite beyond the reach of the junior student—for example, the maximum work performed during a muscular twitch; while other simple and important experiments, such as the effect of temperature on muscular contraction, are excluded from this part.

The book commences with a description of various forms of galvanic cells and the chemical changes involved in their action. Such a description is scarcely necessary, for the student is supposed to be already familiar with the commoner forms of galvanic cell before commencing practical work in physiology; but, if inserted, it would have been much better to have described the action of the cells correctly. For example, the student who has just attended a junior course of instruction in a physical laboratory will be somewhat disturbed in his notions of electrolysis by being told that when the Daniell's element is in action—

> "the chemical changes in the battery are, solution of zinc and formation of $ZnSO_4$ at the zinc plate, and decomposition of the $CuSO_4$, *by the hydrogen appearing at the copper plate* to form H_2SO_4 and metallic Cu, which latter is deposited on the copper surface."

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Similarly, in the case of the Bunsen cell the student is informed that, "the H_2 appearing simultaneously at the carbon pole (?) is oxidised into H_2O by the nitric acid." It is surely a new discovery that hydrogen appears at the negative plate in these elements, and one well calculated to upset all present electrolytic hypotheses.

The induction coil and its action are next considered, and here again some mistakes occur.

> "The E.M.F. of the induced current depends upon several factors: (1) It is directly proportional to the intensity of the current change in the first wire. (2) It is directly proportional to the rate of change of the inducing current."

It is difficult to see any difference between (1) and (2); there is probably a misprint somewhere, but this is precisely the kind of blunder most calculated to waste the time and temper of a student who is not strong in physics. In describing the theory of the extra currents of make and break it is stated that—

> "as the duration of this induced current (the extra current at make) is very short its effect is soon exhausted, but not before it has produced the result that more time is required for the current to reach its full strength than would have been the case if the wire had been perfectly straight."

Now the extra current at make lasts just as long as there is any variation of the primary current, and therefore as long as there is any induced current in the secondary coil, and its effect is no sooner over than any of the other effects involved.

A further error in connection with the same subject is worth noting, since it is not peculiar to this volume, but occurs in other text-books of physiology.

> "On breaking the circuit the circuit of the primary is broken, so that no induction currents can be set up in the primary."
>
> "The fall in potential is therefore instantaneous."

Now the fall in potential at break is *not* instantaneous, otherwise the E.M.F. of the induced current in the secondary circuit would be infinitely great. The primary circuit cannot by any means be instantly broken, and there *is* an induced extra current in the primary at break. Only in the circuit during break there is a high resistance in the spark gap, and both the extra current and the primary current are rapidly diminished by this rapidly increasing resistance.

The more purely physiological part of the book is fairly well written, and contains descriptions and figures of new and sometimes ingenious adaptations of simple apparatus for experimental work. Some of these artifices for making simple apparatus are certain to become extensively used, and it is here that the book will probably render most assistance to teachers of physiology. The book is also copiously illustrated, and contains a large number of reproductions of experimental tracings. Many of these it is impossible for the student to imitate for himself, but they will doubtless form valuable aids in assisting him to recollect the results of class demonstrations.

OUR BOOK SHELF.

L. Rütimeyer. Gesammelte Kleine Schriften allgemeinen Inhalts aus dem Gebiete der Naturwissenschaft. Nebst einer autobiographischen Skizze. Edited by H. G. Stehlin. 2 vols. 8vo. Pp. iv + 400 and 455. With a portrait and woodcuts. (Basel: Georg et C$^{\text{ie}}$, 1898.)

IN these two well-printed and handy volumes we have the more important of the contributions made to science by the late Prof. Rütimeyer, which could be reproduced without costly illustrations. By the kindly care of Leopold Rütimeyer and H. G. Stehlin, we have these as an "In Memoriam" tribute, the crowning stone of which is the very interesting series of notes by Prof. Rütimeyer himself of the chief incidents of his life. In a work of this nature, there is left but little room for criticism, and we will serve the reader's purpose best by a brief notice of the contents of the volumes. In the stray memories of his scientific life we learn that, born in February 1825, his early days were spent in the country; his life was in the open air, wandering over field and meadow, in woods, and up the hill-tops. Educated at home, he records his happiness at having escaped the mischiefs and sorrows of a public school. When sixteen years old, falling under the influence of Bernhardt Studer, his studies took the direction of the natural sciences, and his future career was marked out. In these "Memories" many are the interesting facts recorded in a busy life. As an author he began with a "Memoir on the Nummulitic Region of the Bernese Alps," which was published in 1848, and we have on record a long list, published from year to year, with but few exceptions, until 1895, when in June he put his initials to the "Memories," passing out of the world, though not beyond memory, on the 25th of the following November. Ever fond of nature, his latter years were rendered happier by winter sojourns in the sunny south of Europe.

The memoirs in the first volume are chiefly of a zoological character. We find an essay on the form and history of the vertebrate skeleton; on the historic method in palæontology; on the origin of our animal kingdom; on the limits of the animal kingdom—a critical notice on Darwin's writings; on the alterations in the animal life in Switzerland, since the appearance of man; on the evolution of organic beings. Most of these memoirs were at one time of interest, but while they were, as we think, worth gathering into a volume, it must be confessed that the greater part of their novelty has gone.

The second volume contains a long essay, "Vom Meer bis nach den Alpen," being a sketch of the structure, form and colour of the country met with in a section between England and Sicily; also a paper on the people of the Alps; a glance at the history of glacier studies in Switzerland; a very brightly written sketch of Brittany and its people. Obituary notices of Louis Agassiz, Charles Darwin, Peter Merian, and Bernhardt Studer, bring this volume to an end. There is in an appendix a list of all Rütimeyer's writings, arranged in chronological order.

Recherches expérimentales sur quelques Actinomètres Électro-chimiques. By H. Rigollot, Docteur ès Sciences, Chef des travaux de Physique a l'Université de Lyon. Pp. vi + 138. (Paris: Masson et C$^{\text{ie}}$, 1897.)

IN this work M. Rigollot has collected together, in a convenient form, his researches on photo-electric cells. Two metallic plates being immersed in an electrolyte, and the one exposed to light whilst the other is protected from it, a difference of potential is established between them. The author gives the large amount of valuable information, which he has accumulated in his study of this phenomenon, in the form of experimental results;

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